Note 10

Professional aspirations

How Do They Influence the Choice of a Non-Traditional Field of Study?

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Professional Aspirations: How Do They Influence the Choice of a Non-Traditional Field of Study?

Transitions Project – Note 10

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Introduction

The number of women on the labour market has doubled since 1950 (Meece, 2006) and women account today for 45 to 48% of the labour force in the United States, Canada, Australia and the United Kingdom. Nevertheless, we need to admit that an equal gender distribution does not hold true in all professions. Indeed, there are fewer women in technical and scientific spheres of activity (Acker and Oatley, 1993; Costes, Houadec and Lizan, 2008; Fontanini, Costes and Houadec, 2008; Messersmith, Garrett, Davis-Kean, Malanchuck and Eccles, 2008) and fewer men in spheres linked to children's education and the care of individuals (Besnard and Diren, 2009; Carrington, 2002).

Given labour shortages that prevail in several areas, including the sciences and nursing, and from a viewpoint of achieving equality between men and women, this situation calls for concern. Indeed, this is particularly so because more women than men hold jobs that carry fewer responsibilities, pay less and lack in variety (Beaudelot and Establet, 2007; Meece, 2006; Tahon 2003).

How can we explain that though more women than men are enrolled at the undergraduate level (58% in 2004-05 in Canada) and obtain a degree (Statistics Canada 2009), women are still under-represented in spheres of activity that offer more prestige and better job opportunities? Why is it that, despite incentives to encourage women to choose "non-traditional" programs, they continue to opt for traditionally female fields of study? How should we interpret the fact that men still do not seek jobs pertaining to children's education and the care of individuals?

Research published to date indicates that many factors can influence the choice of a traditional or non-traditional field of study, including social representations, social and cultural origins, motivation, family, peers, previous and current academic experiences, and the individual's gender. At the same time, some studies have examined the influence of professional aspirations on academic and career choices (Béret, 1986, 2002; Felouzis and Sembel, 1997) or have analyzed men's and women's realities in this context (Sikora and Saha, 2009). With this in mind, we will endeavour to answer the following questions: what are the professional aspirations of men and women who are pursuing a post-secondary education in a non-traditional field of study? How do these aspirations evolve over the years? How do professional aspirations influence the choice of a non-traditional field of study and an individual's persistence in such a program?

In order to understand the influence of men and women's professional aspirations within the context of non-traditional fields of study, we elected to define as "non-traditional" programs where the student base has 20% or less women or men. This choice, which is explained in more detail in section 2.2.1 below, allows us to measure the influence of professional aspirations in programs that are markedly traditionally female or male.

First, we look at how supporters of sociocultural, developmental and academic approaches have tried to explain this enduring inequality, be it with respect to professional aspirations, choice of or persistence in fields of study, and this, for both men and women. Following this, we will present a brief summary of research on professional aspirations and their influence on men and women choosing non-traditional programs. We will then analyze the influence of professional aspirations on the choice of a non-traditional field of study by using data from the Youth in Transition Survey (YITS). The issue of persistence in a non-traditional field will also be briefly treated. Finally, the results obtained will be discussed in light of earlier research and the implications for future research on the subject.

1. Theoretical Framework

The influence of gender or sexual affiliation on educational pathways has been addressed in several research fields, such as feminist studies, sociology, biology and psychology. A brief overview of these different points of view follows, with a summary of elements which define more specifically our research subject. That is, the role played by aspirations in professional orientation and persistence in a non-traditional field of study.

1.1 Sociocultural Perspectives

Ever since the 1960s, feminists have been reflecting on women status in society (Acker and Oatley, 1993; Collin, 2000; Toupin, 1999). Their reflections and works were used as the theoretical framework for interventions aimed at gender equality in education. Four positions were extensively developed over the years: liberal egalitarian, essentialist, radical (or constructivist), and postmodern. We will discuss the first in more detail because it is the egalitarian approach that has influenced most sociological studies pertaining to the construction of gender relations and that has placed its mark on the search for explanations in psychology.

1.1.1 Egalitarian Position

From an egalitarian point of view, all human beings are autonomous and equal individuals (Badinter, 1986). Alienation is not linked to the state of being a man or a woman, but to social expectations built upon the definition given to the masculine and the feminine in history (Baudelot and Establet, 2007; Tahon, 2003). In other words, that which refers back to gender. Women's and men's liberation thus reside in rejecting gender assignment, as this is a cultural construction (Héritier, 1996) that gives the deep-seated feeling of belonging to one of the sexes as defined by biology and culture (Chilan, 1999).

Adults, and particularly parents, are responsible for this gender-differentiated socialization. Hence, the family socializes girls inwardly by favouring static activities and the boys outwardly by involving them in vigorous and competitive activities (Duru-Bellat and Jarlégan, 2001). Baudelot and Establet (2007) explain that boys may have more freedom at home than girls, which enables them to experiment, develop self-confidence and a critical eye towards school. The result may be that some boys, no longer capable of dealing with limitations imposed by school, abandon their studies; for others, outward socialization is an incentive to choose streams requiring authority, autonomy and independence.

From the very beginning of schooling, a number of factors may contribute to gender inequality, such as textbooks and workbooks conveying stereotypes, peer pressure, evaluation standards and processes, expectations, teachers' behaviour, etc. (Acker and Oatley, 1993; Fontanini *et al.,* 2008). Teachers in particular are considered at fault: a number of studies (Costes *et al.*, 2008) report that they give more time and attention to boys in the classroom than to girls.

The family circle may also favour the imposition of differentiated standards of conduct. This may be more so during adolescence, when the stereotypes conveyed by the social environment gain in importance, in particular in the case of youth from underprivileged sections of the population. Indeed, these young people may be adhering more to traditional concepts with respect to male and female roles (Costes *et al.,* 2008). Consequently, they may choose fields of study corresponding to gender stereotypes. For instance, girls who plan to work part-time so they can raise a family will enrol in less competitive programs.

Cultural stereotypes are also conveyed beyond school. They have a great resonance in particular in science and technology. Computer science magazines are directed by men, computer games

are often geared towards boys, etc. Magazines about children will show photos of mothers holding toddlers in their arms or female elementary school teachers surrounded by young children.

According to feminists, the most efficient way of curbing discrimination against women is first and foremost a non-sexist education. This is a matter of socializing the social players differently. By changing mentalities, society will change. Acker and Oatley (1993) report that innovations in education that are based on this approach effectively aim at encouraging women to not exclude themselves from science and technology by trying to change attitudes and eliminate stereotypes. This is a matter of, for instance, changing teaching material, providing female reference models, or guiding career choices by suggesting to women that science and technology programs can lead to a career that is right for them, etc.

1.1.2 Essentialist Position

Essentialists underscore the fact that there are two genders within humanity (Fouque, 1995). Gender relations therefore imply that we should look beyond women's status (Tahon, 2003). In order to become a sociological subject in its own right, gender relations must be examined from the perspective of relations that involve both genders, i.e. men's as much as women's. Supporters of this approach suggest that the categories of men and women are not homogeneous and that relations are inevitably asymmetrical. The end of male dominance will enable the emergence of a world that will be enhanced by the input of both genders. Women's advancement will bring new forms of social organization, no longer hierarchical but egalitarian (Irigaray, 1990).

For the essentialists, there is a female and a male nature; this nature guides men's and women's choices and behaviours in society. Innovations in education reveal existing incompatibilities between women's learning process, and standard science and technology practices that are too often set in response to economic requirements (Acker and Oatley, 1993; Beaker and Leary, 1995). Women lean toward cooperation and support and have their own way of learning and working; this would explain why they are more interested in health-related science programs. The science and technology programs' curriculum and teaching methods must therefore be adapted to women's needs.

1.1.3 Radical and Constructivist Position

The radical trend's first target is patriarchy, which it considers as a social system of domination that leads to a bipolarization of the genders around social roles and functions for the benefit of men (Toupin, 1999). Women's oppression by men is the basis of the capitalist system that organizes human relations within society (Delphy, 2001). A woman does not have access to the best jobs, so she remains a dependant because she earns less, and men exploit her, both in the labour market and at home (Blackburn, Browne, Brooks and Jarman, 2002). Patriarchy and collective oppression need to be overthrown.

1.1.4 Post-modern Movement

The post-modern movement started in the late '80s and early '90s and it was strongly influenced by American feminists. The post-modern position is also called deconstructionist because it deconstructs the forms of Western modernity (Tahon, 2003). This deconstruction questions imposed classifications. Identity is no longer centered on male/female duality; it takes into account the numerous characteristics of an individual such as gender, social status and sexual preference (Butler, 1990). The individuals' identity is therefore complex and interventions in education must consider this complexity. American research on subjects that include black women's status in the United States and the homophiles' social experience in school emerged from this movement, leading to demands that differences be recognized.

1.2 Psychosocial Perspectives

Feminists have reflected on gender equality, in particular in the school environment by using different social and cultural perspectives. However,

researchers in psychology claim that, regardless of the sociocultural factors involved, it is the individual, in the final analysis, who makes his or her career choices and who decides whether or not to enrol in a program to carry out these choices. We will present, with this psychosocial perspective, the developmental and academic approach, Eccles' Expectancy Value and Parent Socialization models, as well as the contribution of parents and close relations as viewed by other researchers.

1.2.1 The Developmental and Academic Approach

Studies confirm that women hesitate to undertake a career in science and technology because they continue to value a career that gives them the opportunity to start a family; they anticipate that they will not achieve success in these areas and they question the benefits of these professions (Frome, Alfeld, Eccles and Barber, 2006). Researchers have also identified other psychological determinants: women's low self-esteem when facing difficult tasks, their hesitation to take risks, their belief that success stems from luck while failure results from a lack of skills, etc. Compared to men's, women's level of self-confidence is said to decrease with adolescence (Bariaud, 1999). Despite high success rates in mathematics in high school, women persist in underestimating their capabilities to undertake studies in science (Costes *et al.,* 2008). Because they are influenced by predominant stereotypes, women hesitate to go into programs that require mathematics and are reputed to be difficult, even more so since the required attributes (a scientific and competitive mind) to succeed in these programs do not correspond to female stereotypes. They choose programs that make them feel safe and that are more in tune with their predispositions.

1.2.2 The Expectancy Value Model (Eccles, 1983)

Over the years, Eccles' Expectancy-Value Model was the source of important research to better understand the variables that have an influence over career choices. Published in 1983, this model's initial goal was to explain the differences between boys' and girls' performance in mathematics as well as the significant discrepancy in the number of boys and girls that choose a career in this stream. According to the model, an individual's success in a particular sphere depends on the value that he or she attributes to the tasks at hand, expectations about succeeding as well as motivation (Feather, 1982). An individual may thus attribute a great deal of value to a task in particular, but without expectation of succeeding, he or she is unlikely to put a lot of effort into it. Similarly, if this individual has great hopes of succeeding but he or she considers the task at hand of no value, the individual's motivation and performance will likely be limited.

According to the model, the value of a task, the intent of completing it and expectations about succeeding are influenced by a range of proximal and distal factors that interact in an individual's everyday life. Proximal factors are first and foremost psychological. The personal feeling of being efficient and competent in a given task is at the source of the expectation of succeeding. Next, it is the correlation between the tasks or the field of study and the short term and long term goals that foretells the value that an individual will give to a given task. Finally, basic needs and social identity play an important role with respect to future career choices. Obviously, all these proximal factors are influenced by the individual's social background, i.e. more distal factors. Cultural standards, life experiences, pre-conceived ideas and stereotypes regarding a sphere of activity or a career, in addition to the time required to succeed in a particular field or career, are all important social factors. Over the last twenty years, the Expectancy-Value Model was the basis of a number of studies that resulted in a better understanding of the interaction of factors that influence career choice decisions.

1.2.3 Eccles' Parent Socialization Model

One of the most important models stemming from the Expectancy-Value Model is the Parent Socialization Model (PSM) of Eccles (Parsons) *et al.* (1983). This model illustrates how parents play an important role in their children's choices. According

to this model, the characteristics of the parents, the family and the living environment, in addition to the child's personal characteristics, interact to influence parents' values and expectations and, consequently their parenting behaviour. The role of parents, according to the PSM can be summed up in four points: a) parents are responsible for the social-emotional climate in which their children live, b) they act as a model for their children, c) they provide them opportunities to have their own experiences and d) they communicate their perception and expectations with respect to a career choice. Following this, children develop their own ideas about the pathways they wish to follow.

1.3 Review of the Literature

The following section first provides a summary of recently published articles pertaining to factors that have an influence on men and women's career choices. Then, it discusses the impact of aspirations on the choice of a non-traditional field of study and career.

1.3.1 Factors that Have an Influence on Educational and Career Choices

1.3.1.1 The Contribution of Close Relations

A fair number of research studies have examined the role of close relations in the decision-making process towards choosing a career. Researchers have analyzed how parents, family members, peers and the community could have an influence on the choice of educational pathways (Farmer, 1985; Schulenberg, Vondracek and Crouter, 1984; Trusty, 1998; etc.).

a) Parents, the Family and Other Close Relations

As seen previously, according to Eccles *et al.* (1983), parents provide their children with a cultural context, an environment in which children develop their concept of the world and of the roles they will play in it. Thus, indirectly, parents shape their children's ideas about male and female social roles. Spellke and Grace (2007) explain that parents communicate these concepts of traditional roles at an early stage to their children. Indeed, though they may not be aware of this, parents do not treat their sons and daughters alike (Spelke *et al.*, 2007).

In general, the results of different research works confirm the role played by parents in their children's career choices. Messersmith, Garrett, Davis-Kean, Eccles and Malanchuk (2008) conducted a survey of computer science students. It reveals that, when students refer to past experiences, they report that their parents were models, either because they worked in computer science and drew some satisfaction and pleasure from their job, or simply because computer science was of interest to them and was a topic that was regularly discussed at home. Other participants mentioned that their parents had an influence on them by providing the means or by involving them in pivotal experiences that fostered their interest for computer science. Most of the students stressed that they had benefited from ample reinforcement in a positive environment (without gender differentiation). Similarly, Ciccocioppo and her colleagues (2002) attempted to discover what encouraged or discouraged young women to undertake studies and to persist in science, engineering or technology. Their research used focus groups where women had the opportunity to share their opinions and discuss their experiences and their pathways. In keeping with the previous study's results, the authors concluded that the two major determinants in these young women's career choices had been a) their parents' reinforcement and b) the example set by their parents, who were working in science.

Researchers have emphasized the differential treatment of boys and girls. More specifically, they sought to demonstrate a link between the changes in behaviour that take place depending if one is dealing with a girl or a boy. The study carried out by Tenenbaum, Snow, Roach and Kurkland (2005) clearly shows the impact of this differential treatment. When some mothers and their children were invited to play with small magnets, the researchers observed that the mothers would provide significantly longer scientific explanations on magnetic fields to their sons than to their

daughters. According to these authors, these rudimentary explanations are significantly linked to these children's interest for science recorded two years later. Shibley Hyde (2007) reports similar results in the more ecological context of a museum. According to her, parents would give three times as much explanation of scientific phenomena to their sons than to their daughters. Jacobs, Davis-Kean, Bleeker, Eccles and Malanchuk, (2005) also report that most mothers say that they are more inclined to buy science games, books and toys for their sons than for their daughters, regardless of the child's age. Given the importance of experiences in the choice of a career for the future, clearly these objects, as well as all the rewarding activities organized by the parents, can have an impact on a child's development and his or her subsequent choices. Jacobs, Chin and Bleeker (2006) have also carried out a survey of parents and their children to determine if the parents' stereotyped expectations had an actual influence on their children's career choices. The study demonstrated that parents' expectations were effectively reflected in their children's choices. For example, if parents expect that their child will pursue a post-secondary education (PSE), it is very likely that the child will decide to do so. Similarly, if the parents associate a male or female stereotype to certain careers, it is likely that this stereotype will be reflected in the child's career choices. Ultimately, it is possible to believe that, throughout their childhood, girls benefit from significantly less encouragement towards considering a career in science. Though not necessarily aware of it, parents perpetuate male and female stereotypes and confirm the idea behind Eccles' PSM model, that parents' characteristics and expectations have a strong influence on their children's educational pathways. The tradition of typically male and female careers is therefore passed on to the next generation.

Bleeker and Jacobs (2004) have found that mothers' opinion of their children's skills in mathematics often had an influence on their children's decision to undertake a career in science or math, and this, even when the actual skills in math are statistically controlled. Young women whose mothers perceived their skills in math as being weaker had 66% less chances of choosing a career in physical sciences or computer science than in a non-scientific sphere of activity. Furthermore, according to an analysis by Auster and Auster (1981) of literature pertaining to the issue of women in non-traditional careers, women whose mothers worked outside the home at one point of their lives have better chances of pursuing a post-secondary education and of choosing a non-traditional career. In addition, if the mother has herself worked in a non-traditional sphere of activity, the likelihood that her daughter will choose a more atypical pathway is higher. According to this survey, the mother is a model for the daughters who then start to consider these careers as being much more accessible. For her part, Williams (1996) dwelled specifically on the role played by fathers in non-traditional career choices made by young women. She was trying to ascertain how a father-daughter relationship had an influence on the choice of a career in engineering, science or in the business world. This study's results showed that the choice of a non-traditional pathway was linked to a large degree to the father's level of education. In other words, young women who have chosen more typically male careers have, more often than not, fathers with a higher level of education. The study carried out by Nevitte, Gibbins and Codding (1988) also confirms the role played by fathers in their daughters' career choices. According to these authors, female students whose fathers work in science are far more numerous in this field of study. The father's career can therefore also have an influence on young women's career choices. Lastly, Ciccocioppo and colleagues (2002) stress that the father's role was the most influential factor in the career choices made by the participants in their focus group.

Studies on the factors that have an influence on men's career choices are few and far between. Stroud, Smith, Ealy and Hurst (2000) have carried out a survey of students who wished to become elementary school teachers. They were specifically trying to understand what had influenced their career choices. The results showed that their family

had largely influenced most of the male students who had chosen this career path. More specifically, most of them reported that a family member who was teaching at the elementary level had inspired them.

In addition to parents' roles in career choices, a number of studies stress that siblings, peers and other members of the family are also likely to have an influence on the professional orientation of young adults (Auster and Auster, 1981; Ciccocioppo *et al.*, 2002; Messersmith *et al.*, 2008). Peers' influence on a career choice is said to be significant during adolescence (Auster and Auster, 1981). According to Shibley Hyde (2007), peers have a strong impact on motivation in school and academic performance. At mid-adolescence, we see that children already stereotype mathematical skills as being male and that consequently, young women get much less assistance from their peers for their science and math endeavours. Obviously, this has a considerable impact on young women's interest in these subjects, a fact that can ultimately divert them from non-traditional programs. In addition, 75% of young women pursuing a non-traditional career are the oldest female sibling in the family.

Lastly, it seems that individuals succeed in choosing a pathway thanks to the encouragement, examples, experiences and support offered by a network that includes their family, spouses, peers and other members of their family circle. Though the parents' influence remains the strongest, we must stress that it is individuals with the best overall support network that most often choose the pathway that is most suitable to them. We will see in the following sub-section how the sociocultural and academic environments have an influence on career choices.

b) Sociocultural, Psychosocial and Academic Factors

After collecting data from 55 men and 61 women aged 19 and attending college, American researchers emphasize that, in general, men are as likely as women to make their career choice based on their interest in the profession (Morgan, Isaac and Sansone, 2001). However, this interest defines itself differently according to the gender. Men claim to attach more importance to salary than to time spent on their family or leisure, while women claim to give more importance to interpersonal relations. Lease (2003) tested a non-traditional career choice model Chusmir's model) on men. Among 354 men attending college who had completed a questionnaire in 1986 and responded to a follow-up in 1990, 154 aspired to 10 of the most female-dominated careers while 200 aspired to one of the male-dominated careers. Results indicate that men who show a more liberal attitude towards social roles are more inclined to choose a non-traditional career. Having superior academic skills and wanting to pursue a postgraduate education leading to a prestigious career indirectly encourages the choice of a traditional career.

Sax and Bryant (2006), for their part, have studied how college environment and personal experiences have an influence on men's and women's non-traditional career choices. The results found by these researchers show that the majority of students choose traditional or neutral careers. They observed career changes for a third of the students mainly pertaining to neutral and traditional careers. Furthermore, analyses indicate that for the whole of the sample, time spent on volunteering was linked to a change towards a female-dominated career. Conversely, time spent on the use of a computer was linked to a change towards a male-dominated career. If we focus on the results of female-specific analyses, we see that the wish to start a family or the hope of reaching a higher level of education is related to a change towards typically female-dominated careers. In contrast, women with goals to achieve social status and having a greater interest in science and mathematics are more likely to choose a male-dominated career. Results of male-specific analyses reveal that achievement goals and values (values associated with male/female roles, material values) have an influence on their choice of traditionally male-dominated careers.

Brown, Eisenberg and Sawilowsky (1997) studied the characteristics of 74 women who had chosen a traditional career (mathematics teacher) or a

non-traditional career (engineer) in science. From the outset, the authors stress the fact that expectations of professional success play an important role in women's career choices. More specifically, data indicate that women engineers attach more importance to prestige, flexible hours and avoidance of disagreements with male colleagues than women with a mathematics teaching degree do.

1.3.2 The Nature of Professional Aspirations

In a study that used PISA data to compare career plans in girls and boys attending high school, Sikora and Saha (2009) classified the students' professional aspirations according to two criteria: 1) their socio-economic prestige, using as a model the International Socio-Economic Index of Occupational Status (ISEI) (Ganzeboom and Treiman, 1996), and 2) perceptions of jobs as defined in the Holland Typology (1997). This study confirms that women, in most of the countries surveyed, are aiming at high-level jobs more often than men are. Nonetheless, their professional aspirations remain traditional regardless of their degree of representation in the labour force. The situation is identical in the case of men. Hence, women choose careers in the arts in greater numbers, and men choose careers in engineering in greater numbers. However, medicine and law are relatively mixed.

1.3.3 The Impact of Professional Aspirations on Educational and Career Choices

Studies demonstrate that professional aspirations are by no means definitive at the time men and women declare them. The results of an American survey carried out on two women cohorts in 1968 and 1979, show us, for example, that 56% of women aged 14-16 that had stated a traditional career choice in 1968 ended up choosing male-dominated or mixed professions,[1] while two-thirds of those who aspired to a career in a non-traditional field still had not undertaken such a career by the age of 34-36.[2] Where the 1979 cohort is concerned, the relation between aspirations at 14-16 years of age and employment at the age of 25-27 is tenuous. Indeed, once again, half of the women who declared traditional aspirations during adolescence were employed in a mixed or non-traditional sector. Conversely, more than 85% of the women, who at the age of 14-16 were hoping for a non-traditional career were employed in mixed or female-dominated sectors (Levine and Zimmerman, 1995).[3]

Another survey, this time carried out in the United Kingdom, compared professional aspirations declared by men and women aged 16 with respect to careers in science, health or engineering, and the job they held at age 33. The authors found that 29% of the men and only 3% of the women had expressed aspirations for a career in natural sciences, medical sciences and engineering when they were 16. Engineering was the most frequent choice, particularly in the men's group, followed by natural sciences and medicine. At the age of 33, 6% of those who aspired to a career in science, 24% of those who aspired to a career in health and 3% of those who had mentioned engineering actually held a job that corresponded to their aspirations (Schoon, 2001).

Lastly, a longitudinal survey of 459 men and women in the 9th or 12th grade carried out in 1980, and then 10 years later, compared the factors that had an influence on the choices of a scientific or non-scientific career (Farmer, Wardrop and Rotella, 1999). The authors found that women involved in scientific careers tended, during high school, to view mathematics and sciences as being important in their education and career planning. For their part, men pursuing a career in science had, compared to men in non-scientific careers, higher grade point averages (GPA) in sciences and greater career aspirations. However, compared to women, they did not express as much enthusiasm towards the importance and usefulness of mathematics and sciences. Furthermore, all those who were pursuing a career in science had chosen to take advanced science classes in high school, aimed for prestigious

1 Male- or female-dominated professions are those where there were 70% more men or women in 1980 (Levine and Zimmerman, 1995, p. 75).

2 The authors indicate however that the chi-square test was not significant (Levine and Zimmerman, 1995, p. 79).

3 We must interpret these last results with caution, to the extent that traditional and non-traditional categories of professions are defined, in this study, according to the proportion of women that worked in them in 1980. Indeed, it is possible that the labour market evolved between 1979 and 1990 with respect to job distribution between genders and that "non-traditional" fields became "mixed" because of, among other factors, the massive arrival of women in higher education and their ubiquity in the labour market.

careers and considered that their success in math was linked to the level of their skills in the discipline.

1.4 Summary

This brief overview enables us to see that the issue of gender and academic orientation has been studied from a number of different angles in the past decades. Feminist writings, in particular those adopting an "egalitarian" position, have strongly influenced education policies with respect to equality between boys and girls in school, by revealing the impact of gender-differentiated socialization processes on student's academic future. A quick look at psychosocial works enabled us to recognize the existence of two models to explain academic orientations: a) Eccles' Expectancy Value Model (1983), which stresses the individual's values and expectations towards certain subjects and his or her chances of success, and b) Eccles' Parent Socialization Model (PSM), which focuses more specifically on the influence of parental socialization on children's education choices. This brief review is not exhaustive; the issue of gender and academic and professional orientation was also studied from other viewpoints, including from a biological perspective.[4] That said, given the controversy around this research and the sociological orientation of this research note, we chose to forgo this theoretical perspective.

Given that this research note specifically concerns the educational pathways of men and women in post-secondary education, we formulated a brief summary of factors that have an influence on academic and professional choices. This enabled us to see that these factors are numerous. Families, peers, close relations certainly have a role to play in students' academic and professional choices, but these choices are also influenced by the students' own professional interests, their expectations and values, and their academic performance as well. These last factors highlight the importance of a professional objective in the academic orientation process. Studies on professional aspirations show that the majority of girls and boys have "traditional" aspirations and that these aspirations are not static, but that they evolve over time. However, we did not find studies that dealt specifically with the influence of aspirations on the choice of non-traditional fields of study for young men and women pursuing a post-secondary education. We will therefore attempt to explore this issue more in depth in the rest of this note.

4 See Dickens and Flynn (2001) and Berenbaum and Bryk (2008) on the effect of hormones. Refer to Halpern (2007) and Szirony *et al.* (2007) on the effect of the brain structure. See Moloney (1991) and Haworth *et al.* (2009) on the effect of genes.

2. Methodology

2.1 Source of Data

We use data collected in the first four cycles of the Youth in Transition Survey (YITS), a Canadian-wide survey carried out by Statistics Canada since 2000 on behalf of Human Resource and Skills Development Canada (HRSDC).[5] More specifically, we use data from cohort A. This cohort is composed of youth aged 15 on December 31, 1999, and has an initial sample of 38,000 respondents. The second cohort (called B) initially regrouped 29,000 individuals aged between 18 and 20 at the end of December 1999. To achieve our objectives, we worked with the sample of youth in cohort A that were in the survey during the first four cycles and that had undertaken a post-secondary education before the end of cycle 4. This population is estimated at 11,612 subjects in cycle 4.

2.2 Operationalization

We have seen that many factors can have an influence on the choice of a non-traditional field of study and on the individual's persistence in this field. In some cases, these factors favour the pursuit of traditionally female or male pathways. We should particularly bear in mind prejudices and sexual stereotypes conveyed by society as a whole, as well as those conveyed within families and at school. Other factors can help us to understand the choice of a non-traditional field of study and persistence in this field. In this regard, Eccles' Expectancy Model focuses more on the impact of individual and family factors on career choices.

It would be interesting to consider all these factors together in order to understand the determinants that lead men and women to choose and persist in a non-traditional field of study. It is unfortunately impossible to do so within the framework of this note, because we are using an already existing database, the Youth in Transition Survey (YITS).

Despite certain limitations inherent to a secondary analysis of existing data, the content of the YITS proves to be very revealing. This survey covered, among other things, different aspects of both secondary and post-secondary education. YITS has also gathered information on parents' and students' socio-demographic characteristics through a specific questionnaire. This enables us to measure precisely, for example, the parents' socioeconomic status, the ethno-linguistic group, the country of birth and a range of information, thanks to which we are able to extrapolate the sociocultural characteristics of each respondent and his or her environment.

More specifically, YITS lends itself well to analyzing the effects of gender differences on the choice of a non-traditional field of post-secondary education and on persistence within that field. We find in this survey specific and recurring questions on professional aspirations and self-assessment of skills in various disciplines, two dimensions found in Eccles' Expectancy Model. In addition to the social anchorage variables (parents' socio-professional status, parents' level of education, family income, respondents' cultural capital), YITS also pertains to career orientation initiatives taken by students aged 15 to 17.

Lastly, in addition to this information, which is linked directly to the uncertainties and complexities of this note, the cohort that was chosen for our analysis is the "reading" sample in the 2000 PISA tests, thus giving us access to standardized reading skills results (tracking information, interpreting text and reading) for these young Canadians.

2.2.1 Dependent Variables

For the purpose of this note, we will use two dependent variables: 1) the choice a first non-traditional post-secondary program and 2) persistence in the non-traditional program.

5 Formerly Human Resources and Social Development Canada.

a) The Choice of a First Non-Traditional Post-Secondary Program

Building this variable involved several processes. The first consisted of identifying the first post-secondary program of each respondent, regardless of the survey's cycle. This necessitated a longitudinal tracking of the starting and end dates of all the programs reported by each respondent. In this respect, YITS provides longitudinal indicators that enable the tracking of each program throughout the different cycles of data collection. In a second process, we identified and grouped together the fields of study of the first post-secondary program. We did this by using the "Main field of study or specialization of respondent (C1P1D)" coded according the 55 sections of the *Academic and Occupation-Specific Programs*. In keeping with the issues discussed in this note, we adopted a more precise grouping while respecting the constraints (more specifically the number of observations) imposed by Statistics Canada with respect to data disclosure. The final variable has 77 different fields of study (see Appendix 1). As part of a third process, we explored relevant literature in order to determine a method to classify non-traditional fields of study.

A first method consists of setting a threshold percentage for each gender's representation. If the representation of one or the other is below this percentage within a profession, the latter will be considered as non-traditional. In Québec and Canada, a 33% threshold is generally used (Szczepanick, 2007). The second method, which was developed by Hugues (1985), consists of determining a coefficient of representativeness that indicates the proportion of a gender in a profession compared to its representation in the active population in a given year (Szczepanick, 2007). We tested both methods and decided to use a 20% threshold. We determined this threshold based on the proportion of students enrolled in each field of study for their first post-secondary program. The idea behind this choice is that a student who turns towards a non-traditional field has a four out of five chance of sitting in class next to a student of the opposite sex. In this context, numerical under-representation is real and is actually even more clear-cut than when the 33% threshold is used.[6] This approach enabled us to avoid some pitfalls when classifying certain fields that are generally perceived as neutral or with a female or male bent without being "typically" associated with one gender in particular and which, had the 33% threshold been used, would have fallen in the non-traditional category.[7]

The last stage in this process was the development of an **instrumental variable** for the purpose of specifying the traditional or non-traditional character of a field of study. It is based on the 20% threshold presented earlier and it determines the following categories:

Non-traditional field for men: any program in which men represent 20% or less of the enrolled students;

Non-traditional field for women: any program in which women represent 20% or less of the enrolled students;

Other field of study: all programs in which more than 20% of the students are of a single gender.

b) Persistence in a Non-Traditional Program

Once enrolled in a non-traditional field of study, does the respondent persist in it? The analysis provides answers to this question by using a second dependent variable, built on the respondent's gender and illustrating how his or her situation evolved between the first and the last program. This binary variable presents the following situations for men and women.

Man	• Man persisting in a non-traditional field. • Man not persisting in a non-traditional field.
Woman	• Woman persisting in a non-traditional field. • Woman not persisting in a non-traditional field.

6 There are no nation-wide data enabling us to make this distinction. Existing data are too aggregated by major fields of study.

7 In particular, anthropology, archaeology, human resources management and journalism are where we find more than 66% of women, though these fields are not considered "typically" female. For other examples, see Appendix 1.

2.2.2 Independent Variables

Professional aspiration is the main independent variable when analyzing the choice of a non-traditional field of study. More specifically, we are presenting the information on professional aspirations according to the categories listed in the *Standard Occupational Classification (SOC) 1991*. This variable is broken down into three components; first the gender, then the age and finally whether or not the professional aspiration is oriented toward a traditional or a non-traditional field.

When dividing labour by gender, we analyzed the situations that are specific to each.

For each cycle that included this variable, we retained the main aspirations of men and women enrolled in a non-traditional field of study (see the descriptive analysis).

Given that professional aspirations evolve with time, we isolated aspirations reported at the ages of 15 and 17. This enabled us to analyze the specific influence of aspirations according to the respondents' age.

Consistency of professional aspirations between the age of 17 and 21 is the main independent variable for the analysis of persistence in a non-traditional field of study. To determine this variable, we retained the main aspirations reported at the age of 17 by men and women enrolled in a non-traditional field of study and we verified if these students had held on to these aspirations. The resulting binary variable presents the following situations for men and women:

Man	• Man in a non-traditional field persisting in his aspirations. • Man in a non-traditional field not persisting in his aspirations.
Woman	• Woman in a non-traditional field persisting in her aspirations. • Woman in a non-traditional field not persisting in her aspirations.

In addition to analyzing the effect of professional aspirations, we also studied the influence of other variables on the choice of a non-traditional field of study by men and women. Using these variables enabled us to isolate the adjusted effect of professional aspirations on our dependent variables (see insert 1).

Insert 1

Description of Variables

Name	Definition and operationalization	Categories
SOCIAL AND CULTURAL AFFILIATIONS		
Socio-occupational category (SOC) of parent 1	Built according to occupation and employment status during initial data collection from respondent to "parents" questionnaire (employed or self-employed)	1) Executive or manager 2) Owner 3) Professional 4) Liberal profession 5) Salaried white collar (reference category) 6) Self-employed white collar 7) Blue collar 8) Artisan 9) Unemployed
First generation students (FGS)	This variable is measured with the parents' highest education level. During cycle 1 of the YITS cycle, each parent was required to indicate the highest education level achieved.	1) Both parents with a secondary education or less (reference category) 2) One parent or both with college-level education 3) One parent or both with university education
Parents' annual income	During the initial data collection, each parent-respondent had to report his or her annual income and his or her spouse's income. Categorization was developed by brackets of $5,000, up to $300,000.	Continuous scale
Cultural capital	The ratio was determined using the scores of items pertaining to cultural and educational resources available to the family. We retained the following parameters: 1) Relational and social (e.g. visits to museums, etc.) 2) Actualized (e.g. books and time spent reading) 3) Materialized (e.g. owning a dictionary, textbooks, etc.)	Continuous scale
Linguistic affiliation	This variable was created with the answers to the "mother tongue" question, i.e. language learned in childhood and still understood (PD7P1). It is a proximal variable to determine ethno-cultural affiliation. The purpose is to identify persons whose mother tongue is neither English or French, which in return enables the identification of youth born from immigrant parents (whether born in Canada or not).	1) Allophones 2) Others
GEOGRAPHICAL SITUATION		
Geographic area of residence	Statistics Canada developed this variable using geographic indicators that are based on the Statistical Area Classification (SATYPE). These indicators determine if an area is urban or rural (2001 Census geography).	1) Urban 2) Rural

Name	Definition and operationalization	Categories
Province of residence	Student's province of residence during cycle 2 of YITS, end of secondary education for the majority of respondents.	Canada's ten provinces
EDUCATIONAL BACKGROUND		
Average score in mathematics, language and science in high school	Ordinal variable replicating average scores declared by respondents.	1) 90 - 100% 2) 80 - 89% 3) 70 - 79% 4) 60 - 69% 5) 60% or less
PISA score in reading	Score showing results obtained by students who took a standardized test measuring their skills in reading, tracking and interpreting information.	Continuous scale
VOCATIONAL GUIDANCE		
Vocational guidance at age 15	Score obtained by aggregating answers to several questions asked at cycle 1 of the Survey about activities undertaken by the student in order to gather information on his or her future career.	Continuous scale
Vocational guidance at age 17	Score obtained by aggregating answers to several questions asked in cycle 2 of the Survey about activities undertaken by the student in order to gather information on his or her future career.	Continuous scale
PSYCHOSOCIAL VARIABLES		
Education aspirations at age 15	This variable corresponds to the highest level of education planned by the student in cycle 1 of the survey.	1) Secondary or less 2) Post-secondary (college) 3) University 4) Don't know
Technology skills self-assessment	This score corresponds to the self-assessment made by the student in cycle 2 of the Survey of his or her computer skills. Answers range from 1) poor to 5) excellent.	Continuous scale
Language skills self-assessment	This score corresponds to the self-assessment made by the student in cycle 2 of the Survey of his or her writing, reading and oral communication skills. Answers range from 1) poor to 5) excellent.	Continuous scale
Mathematic skills self-assessment	This score corresponds to the self-assessment made by the student in cycle 2 of the Survey of his or her skills in solving mathematical problems. Answers range from 1) poor to 5) excellent.	Continuous scale

2.3 Analyses

Both descriptive and multivariate analyses were carried out symmetrically for men and women and this, because the definition of non-traditional fields of study relies on a gender-based distribution of the students in each program. It was therefore impossible to do joint, male-female analyses, insofar as the non-traditional field chosen by a woman constitutes a traditional choice for a man and vice versa.

2.3.1 Descriptive Analysis

Our descriptive analysis first lists non-traditional fields of study for men and women. Basic tables showing the professional aspirations at 15, 17 and 21 years of age of men and women enrolled in a traditional or non-traditional post-secondary program follow this list. Given the size of our sample, the analysis of persistence in non-traditional programs and of persistence of professional aspirations is also limited to basic frequency tables.

2.3.2 Multivariate Analyses

Our analysis of the non-traditional field of study was done symmetrically for each gender. We wanted to determine the factors that contribute to a man's or a woman's decision to study in a non-traditional field. For comparison purposes, other analyses verified if the same factors have an influence on men's and women's decision to study in a traditional field. We did logistic regressions using the logit model (explanation in Insert 3, section 3.3.1).

3. Analysis

3.1 The Choice of a Non-Traditional Field of Study

The analysis of the determinants in the choice of a non-traditional field of study must first identify the programs in which we find an under-representation of students of the same sex. As mentioned above (Section 2), we have defined as non-traditional a field of study having a proportion of boys or girls equal to or less than 20%.

Out of a total of 77 post-secondary fields of study, 10 are non-traditional for women and 11 are non-traditional for men (Table 1), which represents 30% of the sample (15% each). Overall, our results corroborate previous studies. Indeed, the traditionally female fields, where men are under-represented, are disciplines that are related to language (e.g. literature), humanities (law, social sciences), health sciences (health, nursing, social services) and education sciences (family sciences, education). In other words, we find in these disciplines the stereotypes of skills associated with women and their traditional roles: helping others, caring for people, educating children, etc. In fact, it is in the field of family sciences and nutrition that the proportion of men is the lowest compared to that of women: 3% versus 97%.

Not surprisingly, men are over-represented in the fields of natural and applied sciences, such as engineering and physics, as well as in technology (information and computer science)[8], disciplines that emphasize mathematical and problem-solving skills. However, the field in which the female presence is virtually non-existent and that remains exclusive to males is the construction trades, where 99% of students in our sample are male. Highly practical, requiring physical strength and short post-secondary education,[9] the construction trades seem to be a sector in which social representation remains highly stereotyped.

Of all the respondents in cohort A of the YITS having pursued higher education, our results indicate that 2.1% of women and 2.5% of men chose a first post-secondary education (PSE) program in a non-traditional field. What motivates these students to defy the stereotypes associated with certain professions and to choose areas of study in which they find themselves in the minority? Are we seeing the effect of pronounced professional aspirations?

8 The differences between general or professional fields and "technical" fields arise from differences in the structure of Canadian education systems. In Québec, students must go through the college level (technical or pre-university) before going to university, which is not necessarily the case in the rest of Canada. For more information on the differences in post-secondary education in Québec and Canada, see Doray, Pierre *et al.* (2009), *Educational Pathways and Transition Modes in Canadian Post-secondary Education* (*Projet Transitions, Note* 4), Montréal, *Canada Millennium Scholarship Foundation* (Number 45).

9 Note that in Québec, unlike the rest of Canada, training related to construction trades is given at the secondary level and allows student to obtain a vocational diploma.

Table 1 – Non-Traditional First PSE Field, YITS, Cohort A, Distribution (%)

Non-traditional fields for women			Non-traditional fields for men		
First PSE program	***Men %***	***Women %***	***First PSE program***	***Men %***	***Women %***
Information sciences	81	19	Linguistics, language and literature	20	80
Computer science	88	12	Law and paralegal	9	91
Computer science technology	82	18	Sociology	19	81
General engineering	92	8	Administrative support services	20	80
Civil engineering	86	14	**Family sciences and nutrition**	3	97
Computer engineering, electronic engineering, electronics	92	8	General education, professional development for education professionals	11	89
Engineering technology	92	8	Education professionals	11	89
Physics	83	17	Social and community services	15	85
Construction trades, mechanic, repairs	99	1	Nursing	5	95
Precision production trades, transportation	94	6	Community support services	7	93
			Other health professions	16	84

3.2 Description of the Professional Aspirations of Men and Women who Choose Non-Traditional Fields

Closely tied to an individual's perception of a profession or occupation, professional aspirations symbolize an objective defined at a specific period in the course of a lifetime. Although it is possible to associate certain professions in traditionally male or female fields by using common sense, from a sociological perspective, such a classification is debatable since it is impossible to determine students' perceptions of the occupations to which they aspire.

To circumvent this problem, we focused on determining the main professional aspirations of girls and boys enrolled in a first post-secondary program of study in a non-traditional field. We established "Top 5 lists" of the more frequent aspirations at the ages of 15, 17 and 21, the three ages at which this information has been collected in the YITS.

3.2.1 The Professional Aspirations of Women in Traditionally Male-Dominated Fields

It should first be noted that, among the 48 listed professional aspirations (Appendix 3), five types of professions (Table 2) were reported as main aspirations by approximately 50% of women. Four of these remain frequent between the ages of 15 and 21, such as becoming a technical professional in the fields of arts, culture and sports (e.g. artisan, athlete, support staff in the film or television industry, etc.), working as a professional in mathematics-computer science (e.g. actuary, statistician, computer programmer), working as a technician in applied sciences (e.g. physical science, life science or engineering technician) and becoming a professional in various branches of engineering

(e.g. mining or geology engineering, etc.). Only three aspirations were cited occasionally: office worker at the age of 15 and guidance/vocational counsellor and university teacher at 21. These preliminary results suggest that the achievement goals of women in non-traditional fields change little with age.

Are these goals specific to women attending a non-traditional field of study or do we find them in other groups of students, notably among men studying in the same fields, or among women in general? (See insert 2 below.) The results presented in Table 2 show that these women are more likely to share their aspirations at 15, 17 and 21 years with men who study in the same fields, the proportion among them stating a given aspiration being generally closer to this comparison group than to that of women in general. If the situation is less striking at 15, it becomes more so at 17, then at 21 years. Indeed, the goals most common to women overall (doctors and professionals in the arts fields), which are initially important at age 15, are less often cited by respondents at 17 and 21 years. Conversely, the achievement goals shared with men in the same fields (engineering professionals, mathematics-computer science professionals, applied sciences technicians) grow in frequency between 15 and 21 years, probably due to their being concretized through academic guidance. Indeed, these goals are consistent with a non-traditional orientation. The majority of the targeted professions require mathematical skills, in addition to being economically valued (Sikora and Saha, 2009). Thus, the professional aspirations of women in non-traditional fields are more related to their "typically male" field of studies than to their gender.

Insert 2 - How to Read Tables 2 and 3

In Tables 2 and 3 below, we indicate, for women and men in non-traditional fields, the five most frequently cited aspirations at 15, 17 and 21 years with the percentage of persons who reported the five aspirations.

To verify whether the choice of aspirations is primarily related to the gender of the respondent or to his/her fields of study, we also indicate, for two comparison groups, the percentage of individuals who reported that aspiration. In the case of women in a non-traditional field (Table 2), the comparison group consists of men in the same fields and women in general in the sample; and for men in a non-traditional field (Table 3), the other groups are women in the same fields and men in general.

For example, among women in a non-traditional field, if the percentage of responses for a given aspiration is closer to that of women in general than to that of men in the same field, one can assume that this aspiration is more common for women regardless of the field of study. This is the case for "Doctors, dentists, veterinarians" in the 15-year group, where 15% of women in a non-traditional field have reported that aspiration, whereas it was reported for 18% of women in general and only 4% of men in traditionally male fields. Conversely, if the percentage of responses for a given aspiration is similar to that of men in the same fields, it can be argued that this is a goal specific to the field. This is the case for "Mathematics-Computer Science Professionals" (Table 2), cited in the 15-year group by 8% of women who will later be in a non-traditional field, 19% of men in the same fields and by only 1% of women in general.

Finally, if the percentage for an aspiration reported by women or men in a non-traditional field is similar in terms of their own gender in general and in terms of the opposite gender within the field, this goal is common to gender and field. For example, again in Table 2, the aspiration of "Technical professional in arts, culture and sports" shows a similar percentage of respondents reporting that goal in the 15-year group for the three comparison groups (8%, 10 % and 7%). However, if the percentage of women or men in non-traditional fields that have mentioned an aspiration differs from both the percentage of their own gender and the opposite gender in similar fields, one can speculate that this is an aspiration specific to the subgroup in question. In Table 2, this is notably the case for "Life Sciences Professional": 8% of women in a non-traditional field have mentioned this goal, compared to 1% of men in the same fields and 3% of women in general.

Table 2 – Distribution (%) of the Most "Popular" Professional Aspirations for Female Students in a Non-Traditional Field, YITS, Cohort A, Cycles 1, 2 and 4

Professional aspirations at 15 years	Women	Women in a non-traditional field (WNTF)	Men in a traditional field (MTF)
Doctors, dentists, veterinarians	18	15	4
Technical professional in arts, culture and sports	8	10	7
Mathematics-computer science professional	1	8	19
Life sciences professional	3	8	1
Applied sciences technical staff	1	6	13
Other engineering professional	1	6	13
Office staff	0	6	1
Sum of TOP 5[10]		47	

Professional aspirations at 17 years	Women	WNTF	MTF
Mathematics-computer science professional	1	19	17
Other engineering professional	1	12	15
Technical professional in arts, culture and sports	7	9	2
Applied sciences technical staff	1	8	13
Doctors, dentists, veterinarians	12	8	2
Sum of TOP 5		56	

Professional aspirations at 21 years	Women	WNTF	MTF
Mathematics-computer science professional	1	12	13
Applied sciences technical staff	1	11	12
Other engineering professional	1	11	8
Guidance/vocational counsellor	10	7	3
Technical professional in arts, culture and sports	5	6	2
University teacher	1	6	0
Sum of TOP 5		47	

10 The TOP 5 is the sum of the percentages of the five main achievement goals mentioned.

3.2.2 The Professional Aspirations of Men in Non-Traditional Fields

As is the case for women, the aspirations of men in non-traditional fields are highly concentrated: the five aspirations most often cited represent about 50% of the responses (Table 3). However, between 15 and 21 years, only two professional aspirations remain in the five most “popular”: educational or guidance counsellor and work in protective services (e.g. police officer, firefighter, military personnel, security guard). Becoming a technical professional in arts, culture and sports (e.g. artisan, athlete, support staff in the film or television industry, etc.) or working in nursing are goals that are also in the “Top 5”, but only between the ages of 15 and 17 in the case of the former and between 17 and 21 for the latter. Furthermore, working as a professional in mathematics and computer science (e.g. actuary, statistician, computer programmer), or becoming a doctor are only commonly mentioned aspirations in the 15-year group. In other words, unlike women in a non-traditional field, men in this situation do not necessarily maintain their professional aspirations over time. Indeed, many aspirations mentioned at 21 years are specific to men in non-traditional fields, notably sales and services (e.g. assistant cook, waiter, cashier), teaching at university or the desire to work as "paraprofessional" staff in the fields of law and social services (e.g. paralegal, social service worker).

It is worth noting that, if "educational counsellor"[11] and "nursing" are aspirations that men in areas of non-traditional study share with women in the same fields, "protection services" and "technical professional in the arts" are aspirations they have more in common with the men in general in the sample (see Insert 2). Compared to women in non-traditional fields of study who have similar aspirations to men in the same fields (thus more "typically male" aspirations), the aspirations of men studying in non-traditional fields seem influenced both by their gender as men (they share professional aspirations with men in general) and by their academic guidance toward "typically female" fields.

11 Note, however, that this typically female aspiration is also shared by 6% of the total sample at 17 and 21 years.

Table 3 – Distribution (%) of the Most "Popular" Professional Aspirations for Male Students in a Non-Traditional Field, YITS, Cohort A, Cycles 1, 2 and 4

Professional aspirations at 15 years	Men in general	Men in non-traditional fields (MNTF)	Women in traditional fields (WTF)
Technical professional in arts, culture and sports	10	17	6
Doctors, dentists, veterinarians	9	12	14
Protection services	7	10	2
Mathematics-computer science professional	10	10	1
Guidance/vocational counsellor	3	6	7
Judge/Lawyer	5	6	6
Sum of TOP 5		55	

Professional aspirations at 17 years	Men	MNTF	WTF
Guidance/vocational counsellor	6	15	13
Protection services	6	12	2
Nursing sciences professional	1	9	13
Psychologist, social worker, counselling	2	7	9
Technical professional in arts, culture and sports	5	6	4
Sum of TOP 5		49	

Professional aspirations at 21 years	Men	MNTF	WTF
Guidance/vocational counsellor	6	14	11
Protection services	7	11	1
Paraprofessional staff in law, social services, teaching	1	8	6
Sales, insurance, real estate	3	7	2
Nursing professional	0	5	15
University teacher	1	5	1
Sum of TOP 5		45	

These initial descriptive results show that women in non-traditional fields of study have professional aspirations more in common with men who study in the same fields than with women in general. They want to do the same jobs as their male peers, and this idea seems to grow more prominent with age. A priori, the lack of female role models in non-traditional fields does not appear to negatively affect these young women's perceptions of their future professions or, at least, their motivation to choose one of these fields as their first post-secondary program.[12] It is also possible that these young women do not perceive these as non-traditional professions, but rather as personal career choices, regardless of the proportion of men generally found in these fields (Langlois, 2007; Szczepanick, 2007). Their career plans may also be influenced by other factors, particularly the search for social status related to scientific careers (Sax and Bryant, 2006) or their sense of competence in mathematics and science (Farmer *et al.*, 1999; Sax and Bryant, 2006).

Men in non-traditional fields reported achievement goals related to their gender, but also goals in common with women in their fields of study. The presence of a typically female goal (nursing sciences) at 17 and 21 shows that men are also considering occupations that are highly identified with women in society. One can therefore speculate that, compared to their peers who aspire to traditional careers, these young men give less importance to the economic value of a profession (i.e. little interest in a field's status) and their perception of their academic skills and their educational aspirations are lower (Lease, 2003; Sax and Bryant, 2006). In France, as part of a study conducted in Normandy, Lemarchant (2007) showed that young men who studied in a non-traditional field at the technical or professional level did so less out of choice, than out of a default selection because of their low academic performance. They were also more likely than young women in a similar situation to consider reorienting their career choice at the end of their program. Although they do not address the situation in higher education, these results allow us to perceive certain tendencies that can shed light on the results of our analysis.

3.3 Modelling the Choice of a Non-Traditional Field of Study

We would now like to verify the influence of professional aspirations on the choice of a non-traditional field of study, while controlling the potential impact of exogenous factors. Some factors are social anchorages, such as social origin (Farmer *et al.* 2001; Lease, 2003; Sikora and Saha, 2009), the family or social environment. Other factors are the characteristics of secondary education, including the schools attended, the type of program, the skills acquired (Sikora and Saha, 2009), relationships with teachers or involvement in extracurricular activities (Farmer *et al.*, 2001, Messersmith *et al.*, 2008; Theoret *et al.*, 2006). In this context, we conducted a multivariate logit analysis (see Inset 3). For comparison, we also conducted the same analysis for men and women studying in traditional areas. The following section presents our main results.

3.3.1 Factors Influencing Women's Choice to Pursue Non-Traditional Fields

According to the results obtained in **model 1** (unadjusted effect of aspirations), six career aspirations initially influenced significantly the choice of a program in a non-traditional field for women (Table 4). Three are reported aspirations at age 15 (life sciences, engineering, applied sciences), and three others at age 17 (mathematics-computer science, engineering, applied sciences). Compared to the aspirations envisaged at 15 years, those reported at 17 years are more significant at 1% and their effect is comparable to that of aspirations reported at age 17 by men in traditionally male fields (**model 3**, unadjusted effect of aspirations). In this sense, the aspirations at age 15, notably concerning the categories "office staff" and "life sciences", are more specific to women in

12 This result goes against the findings of Delisle (2008), who observed that, the more women are under-represented in the fields of scientific studies, the more they adhere to the stereotype that presents science as a male domain, which has a negative effect on their academic motivation in the field. However, our descriptive analysis only takes into account the aspirations of young women actually registered in a non-traditional field and not those of women who considered a non-traditional career path but gave it up before entering post-secondary education.

non-traditional fields. The model explains the nearly 18% probability that a woman will choose a non-traditional field of study when entering post-secondary education.

When other independent variables related to social origin, geographic area, educational background, vocational guidance and certain psychosocial characteristics are introduced into the model (**model 2**, the adjusted effect of aspirations), five of the six aspirations that were initially significant retain their influence, with two reported at the age of 15 and three at the age of 17. "Life sciences" is no longer significant at age 15, which is notably linked to the fact that educational backgrounds were taken into account.[13] However, the effect of the five other aspirations on the dependent variable varied very little with the introduction of independent variables. This shows that the effect of professional aspirations on the choice of a non-traditional field of study is independent of other factors included in the model.

Among the other independent variables having a significant influence on the dependent variable, the fact of living in Saskatchewan or Alberta plays a positive role. This could be explained by the educational options in these provinces (which possibly focus more on traditionally male fields), or by measures put in place to encourage attendance in such programs by women. Similarly, women who feel competent in mathematics are more likely to choose a non-traditional field, which makes sense since non-traditional programs are typically concentrated around these types of skills (see Section 3.1). However, it is interesting that the subjective perception of mathematical skills (self-assessment), rather than objective skills in this discipline (mathematical average), has a significant and positive effect on the choice of program. Conversely, women who feel competent in language (self-assessment) were significantly less likely to pursue a non-traditional field. This result refers to the importance of perceived self-efficacy as postulated by Eccles and colleagues (Eccles *et al.*, 1983). The perception of competency is as important as success itself. If a student succeeds, but attributes this success to luck and not to competence, he or she will have little interest in pursuing further studies. But if the student succeeds and combines this success with personal efforts and competence, he or she will be motivated to continue in the field. The independent variables explain another 7% of the probability of choosing a non-traditional field.

Insert 3 - How to Read Tables 4 and 5

For presentation of results (Tables 4 and 5), we preferred to state the β coefficients instead of odds ratios, since they tend to artificially inflate when regressions are conducted with small samples. In this context, the use of βcoefficients allows for more uniform results.

With regard to the reading of results, if the β coefficients are **positive**, this means that the variable increases the probability of choosing a non-traditional field in the case of models 1 and 2, and a traditional field in the case of models 3 and 4. For example, in Table 4, model 2, women who reported at 15 a professional aspiration of "other engineering" more often choose to study in a non-traditional field (β coefficient of 1.76 significant at the 5% threshold). Similarly, in Table 4, model 4, men who reported a professional aspiration in "applied sciences" at age 15 are more likely to study in a traditionally male field (β coefficient of 0.70, significant at the 1% threshold).

If β coefficients are **negative**, this means that the variable decreases the probability of choosing a non-traditional field for models 1 and 2, and a traditional field for models 3 and 4. For example, in Table 4, model 2, women who feel competent in language are less likely to choose a non-traditional field of study (β coefficient of -0.32, significant at the 10% threshold). Similarly, in Table 4, model 4, men who reported at age 15 having a career goal in "life sciences" less often choose to study in a traditionally male field (β coefficient of -1.17 significant at the 5% threshold).

13 Building preliminary models of analysis with blocks of variables confirms this interpretation.

Table 4 – Logit Model: Determining Factors in the Choice of a Traditionally Male First PSE Program by Women and Men

Choice of program	Women in a non-traditional field		Men in a traditional field	
	Model 1 Unadjusted effect of aspirations	**Model 2** Adjusted effect of aspirations	**Model 3** Unadjusted effect of aspirations	**Model 4** Adjusted effect of aspirations
	ß Coefficient	**ß Coefficient**	**ß Coefficient**	**ß Coefficient**
Aspirations at 15 years				
Other aspirations	Ref.	Ref.	Ref.	Ref.
Medicine	0.22	0.16	-0.91***	-0.74**
Arts, culture, sports	0.65	0.16	-0.54**	-0.60**
Life sciences	1.06*	0.87	-1.16***	-1.17**
Mathematics-computer science	0.69	1.02	0.55***	0.43**
Other engineering	1.82*	1.76**	0.10	0.18
Applied sciences	1.19	0.99	0.59***	0.70***
Office staff	4.85***	4.52***	0.06	0.48
Aspirations at 17 years				
Other aspirations	Ref.	Ref.	Ref.	Ref.
Medicine	-0.09	-0.46	-0.62	-0.57
Arts, culture, sports	0.46	-0.47	-0.42	-0.74**
Mathematics-computer science	4.15***	4.39***	2.04***	2.28***
Other engineering	3.16***	3.22***	1.31***	1.48***
Applied sciences	2.10***	2.22***	0.99***	1.04***
Socio-occupational category				
Manager		1.96		-0.29
Owner		2.24		-0.19
Salaried professional		2.46		-1.12**
Independent professional		1.79		-0.09
Salaried white collar		1.64		-0.30
Blue collar		2.36		0.03
Artisan		2.04		0.39
Unemployed		0.87		-0.22
Independent white collar	.	Ref.	.	Ref.
First Generation Student (FGS)				
Non-FGS college		-0.13		0.13
Non-FGS university		-0.11		-0.10
FGS		Ref.		Ref.
Annual income of parents		-0.02		-0.006
Cultural capital score		-0.005		-0.005
Language group				
Allophone		0.12		-0.17
Other		Ref.		Ref.

Choice of program	Women in a non-traditional field		Men in a traditional field	
	Model 1 Unadjusted effect of aspirations	**Model 2** Adjusted effect of aspirations	**Model 3** Unadjusted effect of aspirations	**Model 4** Adjusted effect of aspirations
	ß Coefficient	**ß Coefficient**	**ß Coefficient**	**ß Coefficient**
Geographic area of residence				
Urban		0.12		-0.25*
Rural		Ref.		Ref.
Province of residence				
Newfoundland and Labrador		0.46		0.41*
Prince Edward Island		0.08		-0.09
Nova Scotia		0.55		0.07
New Brunswick		0.64		-0.15
Québec		-0.74		-0.29*
Manitoba		0.07		-0.17
Saskatchewan		0.93**		-0.22
Alberta		0.88**		0.18
British Columbia		0.43		0.10
Ontario		Ref.		Ref.
Average in languages		0.06		-0.06
Average in mathematics		-0.15		0.09
Average in sciences		-0.04		-0.009
PISA Reading Score		0.003		-0.001
Educational/vocational guidance score at 15 years		-0.004		0.008
Educational/vocational guidance score at 17 years		0.03		0.009
Academic aspirations at 15 years				
College		-0.93		-0.72***
University		-0.84		-1.54***
Don't know		-0.76		-0.78***
Secondary or less		Ref.		Ref.
Self-assessment score in technology skills		0.18		0.17**
Self-assessment score in language skills		-0.32*		-0.50***
Self-assessment score in mathematical skills		0.44***		0.34***
Pseudo-R^2	0.1769	0.2447	0.0968	0.1934
χ^2wald	137.68	294.18	224.85	379.07
N	5522	4983	4361	3788
Constant	-4.26***	-7.94***	-1.18***	1.26

*: p < 0.1; **: p: < 0.05; ***: p < 0.01

We can ask a second question: are the factors influencing women's choice to enroll in non-traditional fields the same as those influencing men's choice to pursue studies in the same fields? Comparing model 2 with model 4 offers some possibilities in this regard.

Models 3 (unadjusted effect of aspirations) and **4** (adjusted effect of aspirations) show that the aspirations that affect the choice of a traditional field for men are essentially the same as those of women, particularly regarding the goals expressed at age 17. However, their influence is not expressed in the same way. The aspirations cited at age 15 (mathematics-computer science and applied sciences) seem to be more influential on men's choices than women's. One might therefore think that the choice of profession and field of study is chosen earlier in men who enter a traditional field. However, this contradicts the results obtained by Sikora and Saha (2009), who found instead that the goals of girls at age 15 were more pronounced than those of boys. However, compared to model 1, model 3 explains a lesser likelihood of choosing a traditionally male field (10% versus 18%).

We should add that the aspirations which have a significant effect for boys do not have the same effect for girls. For example, the desire to be a doctor at 15 years reduces the probability of choosing a traditionally male domain; this goal does not have a significant influence on girls. Conversely, the desire to study engineering has a positive effect on girls and no effect on boys. However, this asymmetry disappears at 17 years: the same factors influence girls and boys in the same way. Moreover, the effect of several goals is greater for girls than it is for boys.

Also, for men (**model 4**), the independent variables having a significant effect on the choice of field differ from those found for women (**model 2**). We must especially remember that the variables that have a significant effect are essentially academic goals and the self-evaluation of skills. Thus, the formulation of academic goals greater than high school at 15 years reduces the probability of entering a traditionally male domain. Conversely, the more a young man feels competent in technology and mathematics, the more likely he is to choose a traditionally male field of study. In the case of self-assessment of language skills, this relationship is reversed. In women, only self-assessment in mathematics has a positive influence on the choice of a non-traditional field.

As for other factors, different forms of anchorages (social origin, linguistic affiliation, parent's income, province of residence, etc.) have little or no significant influence. These results seem to suggest that the orientation of women into non-traditional fields, that is, into "typically male" streams, is not based on the same factors as for men choosing to pursue studies in these same fields.

3.3.2 Factors Influencing Men's Choice to Enter Non-Traditional Fields

The first model (**model 1,** table 5) (unadjusted effect of aspirations) shows that six aspirations initially had a significant effect on the choice of a non-traditional field for males, with two fields mentioned at age 15 (arts, culture and sports, and medicine) and four at age 17 (protection services, psychologists, nursing sciences, academic counsellor). Similar to results presented previously for women, the aspirations declared at 17 years are more significant (at 1%) than those expressed at 15 years. Moreover, they are similar to those reported by women in traditionally female fields (**model 3**, unadjusted effect of achievement goals). The model shows a 6.8% probability of choosing a traditionally female field.

Table 5 – Logit Models: Determining Factors in the Choice of a Traditionally Female First PSE Program by Men and by Women

Choice of program	Men in a non-traditional field		Women in a traditional field	
	Model 1 Unadjusted effect of aspirations	**Model 2** Adjusted effect of aspirations	**Model 3** Unadjusted effect of aspirations	**Model 4** Adjusted effect of aspirations
	ß Coefficient	**ß Coefficient**	**ß Coefficient**	**ß Coefficient**
Aspirations at 15 years				
Other aspirations	Ref.	Ref.	Ref.	Ref.
Arts, culture, sport	0.75*	0.73*	-0.28	-0.34
Medicine	0.73*	1.08**	-0.58***	-0.24
Protection services	0.07	0.05	-0.15	-0.33
Mathematics-computer science	0.41	0.66	-0.78	-0.71
Judge/Lawyer	0.61	0.85	-0.23	-0.15
Guidance/vocational counsellor	0.71	-0.28	-0.30	-0.18
Aspirations at 17 years				
Other aspirations	Ref.	Ref.	Ref.	Ref.
Arts, culture, sport	0.46	-0.49	-0.44	-0.74**
Protection services	1.05**	0.98**	0.20	0.16
Psychologist	1.76***	1.32*	0.34*	0.38*
Nursing sciences	3.94***	4.62***	2.12***	2.24***
Guidance/vocational counsellor	1.16***	1.00**	0.34**	0.42**
Socio-occupational category				
Manager		0.45		-0.34
Owner		0.11		-0.61**
Paid professional		0.66		-0.01
Independent professional		-0.02		-0.56**
Salaried white collar		-0.68		-0.37
Blue collar		-1.57		-0.64*
Artisan		-0.85		-0.56*
Unemployed		1.64*		-1.94***
Independent white collar	.	Ref.	.	Ref.
First Generation Student (FGS)				
Non-FGS college		0.32		-0.46***
Non-FGS university		0.14		-0.42**
FGS		Ref.		Ref.
Annual income of parents		-0.02		-0.006
Cultural capital score		-0.004		-0.04***
Language group				
Allophone		-0.70		-0.36*
Other		Ref.		Ref.

Choice of program	Men in a non-traditional field		Women in a traditional field	
	Model 1 Unadjusted effect of aspirations	**Model 2** Adjusted effect of aspirations	**Model 3** Unadjusted effect of aspirations	**Model 4** Adjusted effect of aspirations
	ß Coefficient	**ß Coefficient**	**ß Coefficient**	**ß Coefficient**
Geographic area of residence				
Urban		0.04		-0.24**
Rural		Ref.		Ref.
Province of residence				
Newfoundland and Labrador		0.31		0.12
Prince Edward Island		-0.16		0.004
Nova Scotia		-0.34		-0.24
New Brunswick		0.26		0.003
Québec		0.09		-0.42***
Manitoba		1.08***		-0.24
Saskatchewan		0.17		-0.02
Alberta		-0.19		-0.07
British Columbia		-0.06		-0.39**
Ontario		Ref.		Ref.
Average in languages		0.14		-0.12**
Average in mathematics		-0.11		-0.13**
Average in sciences		-0.25		-0.08
PISA Reading Score		-0.003***		-0.003***
Educational/vocational guidance score at 15 years		-0.01		0.02
Educational/vocational guidance score at 17 years		-0.10		-0.02
Academic aspirations at 15 years				
College		0.64		-0.42
University		0.48		-0.63***
Don't know		-0.22		0.72**
Secondary or less		Ref.		Ref.
Self-assessment score in technology skills		-0.001		-0.10*
Self-assessment score in language skills		-0.03		0.16*
Self-assessment score in mathematical skills		-0.07		-0.13*
Pseudo-R^2	0.0698	0.1489	0.0440	0.1334
χ^2wald	47.04	140.20	127.77	299.00
N	4361	3788	5522	4983
Constant	-3.95***	-2.71	-1.16***	2.99***

*: $p < 0.1$; **: p: < 0.05; ***: $p < 0.01$

The introduction of other independent variables does not affect the impact of aspirations on the choice of non-traditional fields: all the aspirations remain significant (**model 2**, the adjusted effect of aspirations). Only one change can be observed: the aspiration of "doctor at 15 years" becomes slightly more significant (at 5% instead of 10%), while we see the opposite trend for "psychologist at 17 years" (from 1% to 10%). Among the other variables introduced, having an unemployed parent and living in Manitoba increased the chances of choosing a non-traditional field, while a good result in the standardized PISA[14] test decreased the likelihood. While it is difficult to explain the effect of the socio-occupational category, it is likely that educational options or the labour market influence the academic counselling of men in this province. Furthermore, it is possible that males who obtained good PISA results are more drawn to scientific subjects, which carry more prestige than "neutral" or traditionally male fields (Lease, 2003). These independent variables explained the additional 8% of the probability that a male will choose a non-traditional field of study.

If we compare the choices of men to those of women in the same fields, we see that the aspirations that influence the choice of field are substantially the same (**model 3**, unadjusted effect of aspirations). The only difference: the goal of "doctor at 15 years" has a significant negative influence and "protection services at 17 years" has little significance. This can be explained, first, by the fact that the proportion of women in traditionally female fields who want to be doctors at age 15 is not significantly different from the total sample (14% compared to 18%; see Tables 2 and 3). As well, "protection services" is a "male" goal (see Table 3). Note also that this model has less explanatory significance (4.4%) for women than it does for men (6.8%).

It is also worth noting that, contrary to **model 2**, where few factors other than aspirations influenced the choice of a non-traditional field of study for males, several variables in **model 4** have a significant effect on the choice of a traditional field of study for women. Thus, having a parent who is a property-owner, a professional, a blue collar worker, an artisan or is unemployed has a negative effect on women choosing traditionally female fields. Coming from a moderately to highly educated family, enjoying a certain level of cultural capital and living in Québec and British Columbia have a negative influence on the choice of a traditional field for women. Would these women—those with a certain level of social and cultural capital— be less attracted to professions where their role is sexually stereotyped? Would they be more drawn to mixed-gender fields of study? This is not impossible, if we look at studies published previously on the subject (Costes *et al.*, 2008). Also, the averages in language and mathematics, along with good results on the PISA reading test, had a negative effect on the choice of a traditional field of study. Like men, we can assume that women who are strong academically will more likely be drawn towards scientific programs or more "neutral" socially valued fields. Expressing the aspiration of going to university at age 15 reduces the probability of choosing a traditional program, while not knowing what level of studies to aim for has the opposite effect. Again, these results suggest that women planning to pursue university studies choose "neutral" or "male" programs. These results contradict those obtained by Siska and Saha (2009), who found that women with higher educational aspirations choose to pursue traditionally female fields. This apparent contradiction may depend on how we define "traditionally feminine".

Finally, the self-assessment of technology and mathematical skills has a negative impact on the dependent variable, whereas we find the opposite result with respect to language skills. This latter result seems logical, considering the fact that traditionally female fields rely more on these skills. However, it "contradicts" the results with respect to the average in language and the PISA reading test, which both had negative effects on the choice of a traditionally female program. It is possible that these conflicting results are due to the strong correlation with the "self-assessment of language skills" variable. Note that the addition of

14 Programme for International Student Assessment. The purpose of these tests is not to measure knowledge, but rather to assess students' ability to use skills, in other words to apply knowledge to real-life situations to answer questions or solve problems. Thus, reading (literacy) tests are designed to assess the extent to which the student is able to assimilate and use a text: identify, interpret and use information, etc. Note that the PISA tests are essentially cognitive: they do not address manual skills. In reading, the PISA test measures the capacity to analyze, understand and use text to acquire new knowledge, develop potential and participate in society.

independent variables increases the explanatory power of this model by 9%.

In short, the results of our analysis models indicate, for women, that professional aspirations, especially those stated at the age of 17, are the variables that best explain the choice of a non-traditional field as a first program of post-secondary study (R^2: 17.68%). These aspirations (mathematics-computer science, engineering, applied sciences) also influence men's choice to pursue traditionally male fields, although to a lesser extent (R^2 of 9.68%). Compared to women, men who choose to study in a non-traditional field are less influenced by their professional aspirations (R^2: 6.98%). In fact, given the explanatory significance of the global model for men (R^2: 14.89%), it is possible that this choice is influenced by factors which we could not take into account in our analysis, including the characteristics of the schools attended, standardized results across all disciplines, the influence of family, teachers and peers, as well as extracurricular activities (Farmer *et al.*, 2001; Lease, 2003; Lemarchant, 2007; Messersmith, 2008).

The following insert symmetrically shows the key results of our models in terms of the effect of different factors. It brings four general findings to the fore:

1) Professional aspirations have an effect on the four standard situations. There is a link between professional aspirations and the choice of a traditional or non-traditional field of study.
2) The perception of competence in various disciplines as well as language skills acquired both have an affect on the choice of field of study for men and women, yet are differentiated according to gender or field of study.
3) The province of residence influences, in some cases, the choice of a non-traditional field of study.
4) The social anchorage variables only influence the choice of a traditional field of study.

Insert 4 - Summary Results of Multivariate Analysis

	Women	Men
Orientation toward a **non-traditional** field	• The model explains 24% of the variance. • Several professional aspirations cited at 15 and 17 years linked to "hard" sciences and engineering have a positive effect on the choice of a non-traditional field of study. • Residing in Alberta or Saskatchewan reduces the likelihood of this type of orientation. • The higher the self-assessment of mathematical skills, the greater the probability of choosing a non-traditional field.	• The model explains 15 % of the variance. • Certain professional aspirations cited at 15 years, and especially at 17 years, linked to counselling and care, increase the probability of choosing a non-traditional field of study. • Residing in Manitoba increases the likelihood of this type of orientation. • The higher the PISA reading scores, the more students were drawn to non-traditional fields.
Orientation toward a **traditional** field	• The model explains 13% of the variance. • The professional aspirations that affect orientation choices are substantially the same as for men in non-traditional fields, but their effect is less pronounced. • Several social anchorage variables influence orientation: the more advantageous the social and cultural position, the less likely a traditional field will be chosen. • Living in an urban area reduces the probability of choosing a traditional field. • High academic results (declared or PISA) reduce the probability of choosing traditional fields.	• The model explains 19 % of the variance. • Certain professional aspirations expressed at age 15 have a negative influence on the choice of a traditionally male domain. • Professional aspirations cited at 17 years, linked to natural sciences, have a positive effect on the choice orientation. • Aspirations to pursue higher education have a negative effect on this type of orientation. • The higher the self-assessment of skills in technology and mathematics, the greater the probability of choosing a traditional field. • Self-assessment of language skills has the opposite effect.

3.4 Persistence in a Non-Traditional Field of Study

We have seen above that professional aspirations significantly influenced the decision to pursue a non-traditional program. Should this lead us to believe that maintaining these aspirations over time plays a similar role in persisting in a non-traditional field of study? The following sections aim to explore these issues.

3.4.1 Persistence of Women in Non-Traditional Fields

About 2% of women in our sample chose a non-traditional field of study as their first post-secondary program (N = 115). Of this proportion, in December 2005, 64% had continued studying in a non-traditional field or had obtained a diploma in a related discipline (Figure 1). Thus, although few women initially choose to pursue a non-traditional sector, two thirds will maintain their choice once they start their program.

Is persistence in a non-traditional field related to maintaining of professional aspirations? To explore this question, we limited our sample to women enrolled in a non-traditional field whose goals at age 17 were among the most frequently cited (see Table 2 above). We then checked whether they had reported having the same goals at 21 years (December 2005) as they did at age 17. The results indicate that only 22% had maintained their professional aspirations between the ages of 17 and 21 years (Figure 2). This result is consistent with the literature in Frome *et al.* (2006), who found in their study on the subject that only 18% of women aspiring to an atypical career in late high school had maintained these aspirations seven years later.

Figure 1 – Persistence of Women and Men Registered in a Non-Traditional Field of Study, YITS, Cohort A

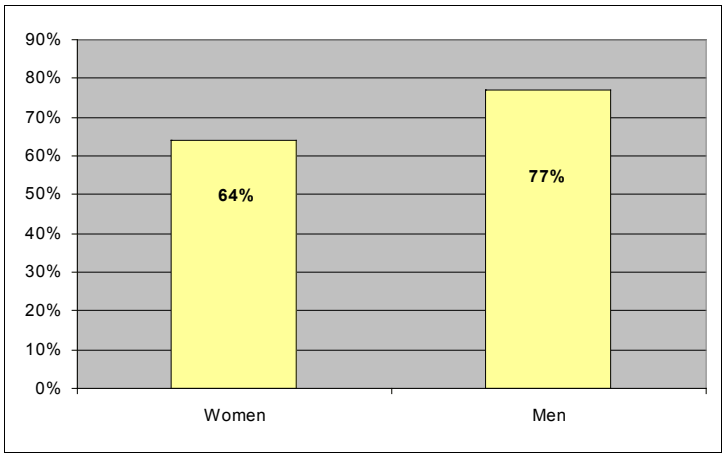
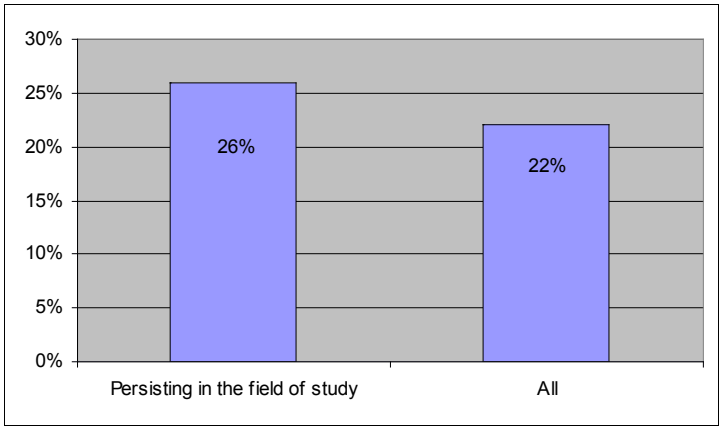


Figure 2 - Proportion of Professional Aspirations Maintained by Women Registered in a Non-Traditional Field of Study, YITS, Cohort A



Since we find that women in non-traditional fields have the same professional aspirations at 17 and 21 years, notably in mathematics-computer science and applied sciences (Table 2, above), we can assume that students who enrol in these fields do not necessarily have "male" professional aspirations before beginning a program, but develop them during their post-secondary education. The career choices would be formed *in situ* in the college or university environment and could be influenced by, for example, the number of courses offered in sciences, the teacher/student ratio, relationships with peers and interactions with the teachers (Sax and Bryant, 2006). Thus the idea raised in Section 3.2.1, that women maintain the same professional aspirations over time, is partly contradicted by this result. While the most common professional aspirations remain the same, it is not always the same people who adopt them at different ages.

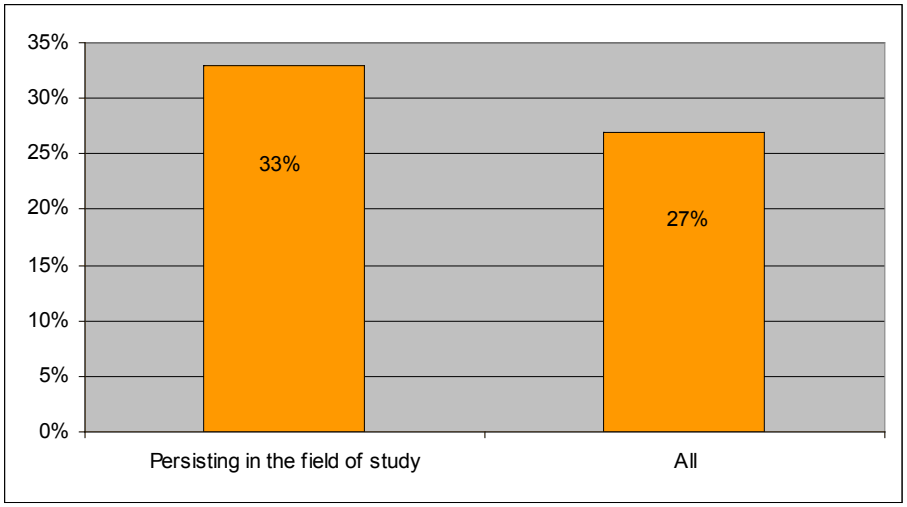
If we restrict our analysis to those women who persist in a non-traditional field and whose aspirations at 17 years were among the most frequently cited, we note that 26% have maintained

their professional aspirations between the ages of 17 and 21. In other words, the maintenance of professional aspirations was slightly higher for those women who persist in non-traditional fields than for women originally enrolled in these types of programs (26% versus 22%, Figure 2). Unfortunately, due to the lack of significant numbers, we were unable to verify whether the persistence in a non-traditional field was higher among women who maintained their aspirations. For the same reasons, we could not use multivariate analysis models.

3.4.2 Persistence of Men in Non-Traditional Fields

The proportion of men in our sample who chose a non-traditional field as their first program of post-secondary study is slightly higher than that of women: 2.5% (N=109) versus 2%. Of this group, in December 2005, 77% continued studying in a non-traditional program or had continued until graduation (see Figure 1, above). Thus, once they have entered a non-traditional program of study, men are more likely to persevere than women in a similar situation.

Figure 3 – Proportion of Men Enrolled in a Non-Traditional Field Who Maintain their Professional Aspirations, YITS, Cohort A



If we retain only men whose professional aspirations were more frequently cited at age 17 and verify the maintenance of their aspirations, we find that only 27% have maintained their professional aspirations between 17 and 21 years. It seems that the men enrolled in non-traditional programs of study continue to develop their professional aspirations to the age of 21. This could be explained by the nature of their interactions with teachers and participation in extracurricular or professional activities (Sax and Bryant, 2006), or because some of them plan to reorient their career choices at the end of their programs of study (Lemarchant, 2007). This result confirms our observation in Section 3.2.2, that men change their professional aspirations over time.

Regarding the maintenance of professional aspirations among those men who persist in non-traditional fields, we note that this applies to 33% between the ages of 17 and 21 years. Maintaining professional aspirations is slightly higher among those men who persist than in men as a whole who initially enrolled (33% versus 27%). However, due to the lack of significant numbers, it was impossible to

verify whether the persistence in the field was stronger in men who maintained their professional aspirations. For these reasons, we could not perform multivariate analysis.

Finally, we should note that the majority of women and men persist in their respective non-traditional fields and that the maintenance of professional aspirations is higher among those who continued in the field; however, professional aspirations changed during the study.

4. Conclusion

4.1 Scientific Significance

A first observation reaffirms the continuing compartmentalization in the choices of fields of study. Thus, despite the existence of many programs and frequent government interventions to encourage women to enter non-traditional professional fields and non-traditional fields of study, women continue to orient their careers toward traditionally female sectors. In fact, only 2% of women in our sample chose a post-secondary education (PSE) program in a non-traditional field. Similarly, few men dare to venture into typically female fields: 2.5% of men in our sample have made this unconventional choice.

Overall, our results confirm the findings of studies documented in our review of the literature. Our analysis indicates that professional aspirations (notably those formulated at age 17) have a strong influence on the choice of a non-traditional field for men, but even more so for women, demonstrating the importance of having an interest in a profession in the choice of a future career (Morgan, Isaac and Sansone, 2001). In this regard, it would be useful to understand how individuals progressively construct these professional aspirations. It would also be interesting to see if, as in the Eccles Expectancy Value Model, the concordance between goal (professional aspiration) and task (program of study) fosters opportunities for academic success.

Similarly, the influence of aspirations persists once we take into account other factors such as social and cultural affiliation, geographic area, academic guidance and approaches to vocational guidance or psychosocial dimensions. Among these variables, it appears that geographic area and self-assessment of skills have the greatest impact on choosing a field of study. Explaining the influence of the province of origin on the choice of a non-traditional field of study requires further exploration of the educational and professional opportunities in these provinces, a task that, unfortunately, could not be accomplished as part of this study. However, regarding the perception of abilities, the findings in the literature show that this factor is a determinant of academic success (Eccles' Expectancy Value Model), which has an impact on the professional aspirations of students (Eccles *et al.*, 1983, Farmer *et al.*, 1999; Sax and Bryant, 2006), whether female or male.

We have seen that self-assessment skills proved to be a significant variable for women who have chosen a non-traditional field of study, but even more so for men and women oriented toward traditional fields. We may hypothesize that the feeling of competence in a discipline is reinforced when the gender of the individual corresponds with the gender stereotype associated with it (e.g., girls are good in literature, boys in mathematics). It should be noted, however, that the YITS data does not allow us to take into account other factors that may affect the choice of a field of study, such as the influence of family, teachers and peers as well as extracurricular activities.

With regard to persistence in non-traditional fields, we observe a low dropout rate. On the other hand, as suggested in the literature (Levine and Zimmerman, 1995; Schoon, 2001; Frome *et al.*, 2006), it seems that aspirations evolve over time. Indeed, few individuals with non-traditional professional aspirations at the secondary level maintain them over time. Thus, our results indicate that aspirations are formed and transformed over the course of an individual's school experience.

In this research paper, we have chosen to categorize the non-traditional fields of study according to a more exclusive numerical threshold (20% or less) than that typically used in studies on non-traditional sectors (33% or less). In the absence of objective and national data on proportions of men/women in different fields of post-secondary education in Canada, this methodological choice was based on a desire to isolate the programs where

men/women were significantly over-represented to avoid any "ambiguous" outcome. That said, it would be interesting to probe the methodological work surrounding this issue further by performing analyses with different thresholds of numerical representation, either more exclusive (e.g. 15%) or more inclusive (e.g. 33%).

4.2 Practical Significance

How can we encourage more women and men to enrol in non-traditional fields of study? In other words, in the light of our results, what means can we put forward to encourage women to enter fields of study leading to professions in mathematics, applied sciences and engineering? How can we encourage men to enter the fields of nursing sciences and guidance counselling? In their study, Theoret *et al.* (2006) present certain interventions in three areas (teacher training, family and living environment, and primary and secondary education) that would allow the situation to evolve.[15]

4.2.1 Teacher Training

Although we were not able to verify the impact of disciplinary teaching on the choice of a non-traditional career, the literature demonstrates the importance of school experience on the development of academic and professional goals (Farmer *et al.*, 1999).

In this context, to increase young girls' interest in careers in science, it is important to offer scientific training to future elementary school teachers. Attracting graduates in natural sciences to teach secondary school in this field can be a way to allow more graduates in this sector to flourish through the sharing of scientific knowledge with young people. Although it may seem difficult to achieve at the present time, mainly because of stereotypes that remain deeply rooted in the perception patterns of men and women, it seems nevertheless important to try to raise awareness among teachers about the effect that their conception of science can have on the academic orientation of their students. In addition, encouraging mentoring among women scientists and science teachers, or between high school and university students, could be a way to reinforce the interest in the sciences among girls.

Finally, it is important to deconstruct myths and combat the prejudices that are still pervasive among teaching staff regarding the stereotypical roles of men and women. In so doing, not only would girls be more likely to choose careers in science, but boys would also be more likely to choose occupations generally associated with female characteristics, such as occupations related to helping and caring for people or teaching children.

4.2.2 Family and Living Environment

Clearly, the family has a role to play in choosing a non-traditional field of study. Thus, it is important to support girls in their academic or scientific career plans and help them overcome the insecurity that may stem from achieving only average academic results. In addition, coming from a "liberal" family, where men's and women's roles do not necessarily correspond to social stereotypes, promotes greater social tolerance among boys (Lease, 2003), making them more open to pursuing non-traditional career paths. In all cases, allowing young people to have access to leisure activities related to non-traditional careers (e.g. science activities for girls or caring for children for boys) will give them the opportunity to explore unsuspected interests. This must, however, be paired with better dissemination of information on the variety of technical and non-traditional occupations available.

4.2.3 Primary and Secondary Schooling

To enable students to make informed and more diversified choices, it is important that they are made more aware of the possibilities available to them regarding technical subjects, professions and study areas. In the case of boys, career counsellors could help them in choosing their career path and in developing their interest in a traditionally female field. It would also be preferable to improve science instruction in more socio-economically disadvantaged milieus with the aim of facilitating access to more prestigious professions not only along gender lines but also based on social background.

15 This study focuses primarily on girls in science. The aspects regarding boys come from other sources or are inspired by the proposals of Théorêt *et al.* (2006).

4.3 Follow-up on this Work

This research note is a first step towards a better understanding of the determining factors in the choice of non-traditional paths for men and women. The continuation of our approach requires further analysis to understand better the process involved in the development and transformation of professional goals as well as their effect on the choice of a non-traditional field of study and their persistence on that path.

Furthermore, this work limited itself to examining the selection of and persistence in a non-traditional field of study. However, there is not necessarily a correlation between the field of study and the occupation undertaken afterward: an individual who chooses to study in a field does not necessarily end up working in that field. There is a big difference between wanting to work in a non-traditional field and the opportunity to do so (Levine and Zimmerman, 1995; Schoon, 2001). Do we know if women and men enrolled in a non-traditional field of study are able to fulfill their aspirations? According to Levine and Zimmerman (1995, pp. 80 and 82), for women, there are few links between non-traditional aspirations in high school and non-traditional jobs held later. Conversely, Schoon (2001, p. 130) indicates that there is a stronger link among men between career aspirations and jobs in the field of science held thereafter. A logical extension of this work would be to check whether respondents enrolled in non-traditional fields of study continued on this path once they entered the labour market.

Appendix 1

Comprehensive List of Fields of Study and Male/Female Distribution of Students Enrolled in a First PSE Program, YITS, A Cohort

Classification - First and Last Post-Secondary Program

Programs	First program	
	Men (%)	Women (%)
Neutral Programs		
Agriculture and Natural Resources	56	44
Wildlife and Forestry	56	44
Architecture and Design	49	51
Communications Technician	59	41
Graphic Communications	57	43
Personal and Culinary Services	54	46
Biological and Physical Sciences	44	56
Natural Sciences	47	53
Parks, Recreation and Leisure	52	48
Physical Education	50	50
Philosophy and Religious Studies	56	44
Theology and Religious Vocations	45	55
Criminology	47	53
Geography	46	54
Political Science and International Relations and Affairs	55	45
Film/Video	41	59
Music	40	60
Business/Commerce General	55	45
Business Administration Management and Operations	55	45
Accounting	48	52
Marketing	50	50
History	47	53
Area and Ethnic Studies	32	68
Communication Studies	28	72
Journalism	32	68
Media and Publishing Professionals	37	63
Disciplinary Teaching	38	62
Liberal Arts	38	62
General Biology	35	65
Biochemistry, Biophysics	36	64
Pharmacology	32	68
Biological Sciences, others	36	64
Multidisciplinary Studies	37	63
Social Sciences, general	34	66
Anthropology and Archaeology	33	67
Drama and Dance	28	72
Visual Arts	30	70
Health Services, General	30	70

Programs	First program	
	Men (%)	Women (%)
Neutral Programs		
Medicine, Pharmacy, Veterinary Studies	30	70
Tourism Administration	36	64
Human Resources Management	30	70
Sales	36	64
Microbiology	62	38
Mathematics-Statistics	60	40
Chemistry	65	35
Other Physical Sciences	62	38
Mechanical Engineering	77	23
Other Engineering	73	27
Security and Protective Services	68	32
Economy	60	40
Other Business Services	61	39
Finance	59	41
Languages and Literature	25	75
Psychology	22	78
Design, Art, Crafts	21	79
Health Technician	23	77
Traditionally Male-Dominated Programs		
Information Sciences	81	19
Computer Science	88	12
Computer Science Technician	82	18
Engineering General	92	8
Civil Engineering	86	14
Computer, Electronic, Electrical Engineering	92	8
Engineering Technician	92	8
Physics	83	17
Construction Trades, Mechanics and Repairers	99	1
Precision Production Trades, Transportation	94	6
Traditionally Female-Dominated Programs		
Sociology	19	81
Law and Legal Support Services	9	91
Business Operations Support and Assistant Services	20	80
Linguistic, Languages and Literature	20	80
Family Science and Nutrition	3	97
General Education, Teacher Education	11	89
Education Professionals	11	89
Social and Community Services	15	85
Nursing	5	95
Community Support Services	7	93
Other Health Professions	16	84
Sample	**N = 14363**	

Appendix 2

Documentation of Post-Secondary Programs

The classification is based on the Classification of Instructional Programs (CIP), Canada 2000. The hyperlink for the complete document is http://www.statcan.gc.ca/pub/12-590-x/12-590-x2005001-eng.pdf

Refer to pages: 19-67.

Post-Secondary Programs	CIP Codes
"Mixed" Programs	
Agriculture and Natural resources	1.00-1.99; 3.01; 3.02; 3.99
Wildlife and Forestry	3.05-3.06
Architecture and Design	4.02-4.99
Area and Ethnic Studies	5.01; 5.02; 5.99
Communication Studies	9.01
Journalism	9.04
Media and Publishing Professionals	9.07; 9.09; 9.10; 9.99
Communications Technician	10.01; 10.02; 10.99
Graphic Communications	10.03
Personal and Culinary Services	12.03; 12.05; 12.99
Disciplinary Teaching	13.13; 13.14
Mechanical Engineering	14.19
Other Engineering	14.02-14.07; 14.11-14.14; 14.18; 14.20-14.23; 14.25; 14.27; 14.31;14.34-14.36; 14.38; 14.39; 14.99
Languages and Literature	23.01-23.99; 55.01; 55.04; 55.05
Liberal Arts	24.01
General Biology	26.01
Biochemistry, Biophysics	26.02
Microbiology	26.05
Pharmacology	26.10
Biological Sciences, others	26.03; 26.04; 26.07; 26.08; 26.09; 26.11; 26.12; 26.13; 29.99; 41.01
Mathematics-Statistics	27.01; 27.03; 27.05; 27.99
Multidisciplinary Studies	21.01; 25.03; 30.05; 30.08; 30.10; 30.11; 30.14; 30.15; 30.17; 30.19; 30.20; 30.22; 30.23; 30.24; 30.25; 30.99; 32.01; 35.01
Biological and Physical Sciences	30.01
Natural Sciences	30.18
Parks, Recreation, Leisure	31.01; 31.03; 36.01
Physical Education	31.05
Philosophy and Religious Studies	37.01; 38.01; 38.02
Theology and Religious Vocations	39.02-39.99
Chemistry	40.05
Other Physical Sciences	40.01; 40.02; 40.04; 40.06; 41.02; 41.03
Psychology	42.01-42.99

Post-Secondary Programs	CIP Codes
"Mixed" Programs	
Security and Protective Services	43.01; 43.02; 43.99
Social Sciences, General	45.01; 45.12; 45.99
Anthropology and Archaeology	45.02; 45.03
Criminology	45.04
Economics	45.06
Geography	45.07
Political Science and International Relations and Affairs	45.09; 45.10
Drama and Dance	50.03; 50.05
Design, Art, Crafts	50.02; 50.04
Visual Arts	50.01; 50.07
Film/Video	50.06
Music	50.09
Health Services, General	51.00
Medicine, Pharmacy, Veterinary Studies	51.04;51.11; 51.12; 51.17; 51.18; 51.20; 51.24
Health Technician	51.08; 51.09; 51.10
Business/Commerce General	52.01
Business Administration Management and Operations	52.02
Accounting	52.03
Finance	52.08
Tourism Administration	52.09
Human Resources Management	52.10
Marketing	52.14
Sales	52.18; 52.19
Other Business Services	52.06; 52.07; 52.11; 52.12; 52.13; 52.15; 52.17 ; 52.20; 52.99
History	54.01
Traditionally Male-Dominated Programs	
Information Sciences	11.01
Computer Science	11.02; 11.07
Computer Science Technician	11.03 11.05; 11.06; 11.08; 11.09; 11.10; 11.99
Engineering General	14.01
Civil Engineering	14.08
Computer, Electronic, Electrical Engineering	14.10
Engineering Technician	15.01-15.99
Physics	40.08; 40.99
Construction Trades, Mechanics and Repairers	46.01-47.06
Precision Production Trades, Transportation	48.01-49.99

Post-Secondary Programs	CIP Codes
TRADITIONALLY FEMALE-DOMINATED PROGRAMS	
Family Science and Nutrition	12.04; 19.00-19.99
General Education, Teacher Education	13.01; 13.06; 13.07; 13.12
Education Professionals	13.09; 13.10; 13.11; 13.15
Linguistic, Languages and Literature	16.01-16.99
Law and Legal Support Services	22.01-22.99
Social and Community Services	44.02-44.99
Sociology	45.11
Nursing	51.16
Community Support Services	51.02; 51.15; 51.23
Other Health Professions	51.07; 51.22; 51.26; 51.27; 51.31; 51.33-35; 51.37 51.38; 51.99
Business Operations Support and Assistant Services	52.04

Appendix 3

Documentation of the Variable "Professional Aspiration at Age 30"

To ensure comparability of collection cycles of the YITS, we have retained the same structure for the three cycles using the Standard Occupational Classification (SOC), 1991. As indicated in the data, some categories have an insufficient sample for disclosure; in these cases, it would therefore be preferable to propose new groupings.

Employment Categories	Codes Corresponding to SOC, 1991
0- Senior Management	A011-A016
1- Specialist Managers	A111-A141
2- Managers in Retail Trade, Food and Accommodation Services	A211-A222
3- Other Managers	A301-A392
4- Professional Occupations in Business and Finance	B011-B022
5- Finance and Insurance Administrative Occupations	B111-B116
6- Secretaries and Administrative Occupations	B211-B415
7- Clerical Occupations	B511-B575
8- Physical Science Professionals	C011-C015
9- Life Science Professionals	C021-C023
10- Civil, Mechanical, Electrical and Chemical Engineers	C031-C034
11- Other Engineers	C041-C048
12- Architects, Urban Planners and Land Surveyors	C051-C054
13- Mathematicians, Systems Analysts and Computer Programmers	C061-C063
14- Technical Occupations in Applied Sciences	C111-C175
15- Physicians, Dentists and Veterinarians	D011-D014
16- Optometrists, Chiropractors	D021-D023
17- Pharmacists, Dieticians and Nutritionists	D031-D032
18- Therapy and Assessment Professionals	D041-D044
19- Nurse Supervisors and Registered Nurses	D111-D112
20- Technical Occupations in Health Care	D211-D235
21- Assisting Occupations in Support of Health Services	D311-D313
22- Judges/Lawyers	E011-E012
23- Psychologists, Social Workers, Counsellors	E021-E025
24- Policy and Program Officers, Researchers	E031-E038
25- University Professors	E111-E112
26- College Instructors	E121
27- Elementary School Teachers	E132
28- Secondary School teachers	E131
29- School and Guidance Counsellors	E133
30- Paralegals, Social Service Workers and Occupations in Education	E211-E216
31- Professional Occupations in Art and Culture	F011F036
32- Technical Occupations in Art, Culture and Sport	F111-F154
33- Sales, Insurance, Real Estate	G011-G211

Employment Categories	Codes Corresponding to SOC, 1991
34- Retail Salesperson, Cashier, Food Service	G311; G511-G513
35- Chefs	G411-G412
36- Security Guards and Related Occupations	G811-G631
37- Occupations in Travel and Accommodations	G711-G732
38- Childcare and Home Support Workers	G811-G814
39- Sales and Service Occupations	G911-G983
40- Construction Contractors	H011-H325
41- Mechanics	H411-H435
42- Other Construction Trades	H511-H535
43- Heavy Equipment Operators	H611-H832
44- Occupations in Agriculture	I011-I017
45- Occupations in Forestry, Mining, Fisheries, Primary Production Labourers	I021-I216
46- Supervisors in Manufacturing	J011-J197
47- Assemblers and Labourers in Processing and Manufacturing	J211-J319

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